

Application No. 09/927,863

SUPPORT FOR AMENDMENTS

The amendment to claims 1 and 19 is supported by claim 7. Claim 3 has been clarified. Claim 31 is supported by claim 1 and 3. Claim 32 is supported by claim 2. Claims 33-38 are supported by claims 4-9, respectively. No new matter has been added. Upon entry of this amendment, claims 1, 2, 4-23 and 31-38 are present and active in the application.

REMARKS

The present invention relates to the field of shallow trench isolation (STI). STI allows the fabrication of isolation trenches in semiconductor devices without the undesirable Beard's Beak formation. Usually, a semiconductor substrate is made by forming a pad oxide layer over a silicon layer. A nitride layer is then deposited on the pad oxide layer, and a photoresist is deposited on the nitride layer. The photoresist is patterned with photolithography and the nitride layer, the oxide layer, and the silicon layer are etched, obtaining the trench. The performance of STI devices can be adversely affected by the presence of sharp bottom corners and sharp top corners in the trench. In addition, defects may be introduced such as micromasking structures, which are generally caused by residual polymeric material produced from the etching chemistries used to etch the nitride layer and the pad oxide layer. The present invention addresses these disadvantages.

As specified in amended claims 1 and 19, the present invention includes an oxide etch chemistry comprising CF_4 and CHF_3 , and which is different from the nitride etch chemistry. New claims 31-38, specify a nitride overetch that uses the nitride etch chemistry.

The rejections of claim 1-6 and 8-23 under 35 U.S.C. 102(b) over Chen et al., and under 35 U.S.C. 103 (a) under Chen et al. further in view of Kim, Bhardwaj, or Kosugi, has been obviated by appropriate amendment. Claim 7 has been incorporated into claims 1 and 19.

The rejection of claim 7 (now incorporated into claims 1 and 19) under 35 U.S.C. 103 (a) under Chen et al. in further view Huang is respectfully traversed. Huang

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describes an oxide etch chemistry that is the same as the nitride etch chemistry of Chen et al. and Huang et al..

Chen et al. describes forming top rounding in a shallow trench etch. The etch chemistry used for the nitride etch uses four gasses: methane trifluoride (CHF_3), carbon tetrafluoride (CF_4), argon (Ar) and oxygen (O_2) (col. 3, lines 1-13). A nitride overetch, and an oxide etch, uses three gasses: methane trifluoride (CHF_3), methane monofluoride (CH_3F), and argon (Ar) (col. 3, line 22-37). There is no suggestion to use carbon tetrafluoride (CF_4) in the oxide etch.

Huang et al. describes a method for STI-top rounding control. After forming a hard mask of silicon nitride, and a oxide layer, photoresist is patterned, and the hard mask and the oxide layer are etched with a mixture of $\text{CHF}_3/\text{CF}_4/\text{O}_2/\text{Ar}$ or SF_6/CHF_3 (col. 2, lines 36-51). The carbon tetrafluoride (CF_4) containing etch is the same for both the nitride and the oxide layers, and is the same as the nitride etch of Chen et al..

Claims 1 and 19, and claims dependent thereon, specify oxide etching chemistry comprising CF_4 , and that the oxide etching chemistry is different from the nitride etching chemistry. Chen et al. use oxide etching chemistry that does not contain CF_4 . The oxide etch chemistry of Huang et al. does contain CF_4 , but it is the same chemistry as the nitride etch chemistry. Finally, since the nitride etch chemistry of Chen et al. and Huang et al. are same, combining these two reference still leads to etch oxide etch chemistry that is the same as the nitride etch chemistry: neither reference suggests oxide etch chemistry that contains CF_4 and which is different from the nitride etch chemistry. Accordingly, the claimed invention is not obvious over the applied references. Withdrawal of this ground of rejection is respectfully requested.

Claim 31 corresponds to original claim 3 in independent form, which was rejected over Chen et al., and is distinguished from this reference. Chen et al. overetches the silicon nitride layer using oxide etch chemistry, not nitride etch chemistry.

Chen et al. is described above. The overetch of the nitride layer is carried out using the etch chemistry of the oxide layer (col. 3, line 22-37).

Claim 31, and claims dependent thereon, specify overetching the nitride layer using the nitride etching chemistry. Chen et al. only suggest overetching the nitride

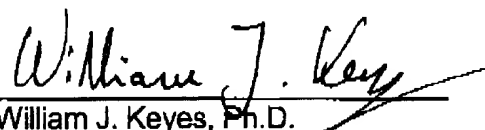
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layer using the oxide etch chemistry. Accordingly, these claims are further distinguished from this reference.

The objections to claims 3, 18 and 19 have been obviated by appropriate amendment.

Applicants submit that the present application is now in condition for allowance. Early notice of such action is earnestly solicited.

Respectfully submitted,



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